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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/058,543	01/28/2002	Khalid Al-Kofahi	RPI-109US	3729

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EXAMINER	
BOWEN, MICHAEL WAYNE	
ART UNIT	**PAPER NUMBER**
2625	

DATE MAILED: 09/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/058,543	AL-KOFAHI ET AL.	
	Examiner	Art Unit	
	Michael W. Bowen	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 January 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *17-22 and 25* is/are allowed.

6)☒ Claim(s) *1-10,12,16,23 and 24* is/are rejected.

7)☒ Claim(s) *11 and 13-15* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 January 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/15/02*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-4, 7-10, 12, 16, 23, and 24 are rejected under 35 U.S.C. 102(e) as being anticipated by Aylward et al. in U.S. Patent number 6,690,816 (hereinafter known as Aylward). Aylward reveals the following:

A method (col. 2, line 19) of automatically tracing a line-structure (i.e. 1-D central track...along the tubular object's length, col. 6, lines 29-32) comprising an end in an image, the method comprising the steps of:

locating a seed point (i.e. a seed point may then be designated, col. 6, lines 26-27; fig. 5, item 515);

defining a position (i.e. locations where candidate seed points exist, col. 10, lines 25-26) and a direction (i.e. direction of maximum intensity, col. 11, lines 2-5; fig. 5, item 520) for the seed point;

tracing a centerline of the line-structure from the seed point (i.e. Seed points are starting locations in the image where tubular object extraction begins and are

preferably designated near the 1-D central track of interest, col. 7, lines 28-30); and

stopping the centerline trace at the line-structure end (i.e. A test is performed...to determine if any stop criteria are met, col. 11, lines 59-60).

3. Regarding claim 2, Aylward reveals the following:

The method of claim 1 wherein the step of locating a seed point comprises identifying a plurality of candidate seed points (i.e. a large number of seed points, col. 8, lines 6-11; candidate seed points, col. 10, lines 8-11) and selecting a seed point from the plurality of candidate seed points (i.e. automatically identifying seed points, col. 9, lines 56-59).

4. Regarding claim 3, Aylward discloses the following:

The method of claim 2 wherein the step of identifying the plurality of candidate seed points comprises identifying image data points that (1) are a local intensity maximum (i.e. searching the...image for seed points, and testing each image element using the tubular extrema criteria, col. 9, lines 56-59; Tubular Extrema Criteria, col. 8. line 13; The point may be a local maximum, col. 8, line 38), and (2) have an intensity of at least a sum of a median intensity value and an intensity standard deviation over the intensity variation of the image (i.e. intensity threshold...determined by analyzing image statistics, such as, for example,

performing a histogram analysis to estimate the mean and standard deviation of intensities, col. 10, lines 11-17).

It is noted that the histogram cited above represents intensity values grouped into bins, one of which consists of a sum of median values.

5. Regarding claim 4, Aylward reveals the following:

The method of claim 2 wherein the step of selecting the seed point comprises calculating a position intensity (col. 10, line 7) and a boundary direction at a plurality of boundary points surrounding the plurality of candidate seed points (fig. 7, vectors 715a, 715b, 735a, and 735b, which are directed toward the boundary).

6. Regarding claim 7, Aylward discloses the following:

The method of claim 2 wherein the step of selecting the seed point comprises calculating an intensity of the image surrounding the candidate seed point (i.e. The point may be a local maximum, col. 8, lines 38-40).

7. Regarding claim 8, Aylward reveals the following:

The method of claim 7 wherein the step of selecting the seed point comprises evaluating the intensity homogeneity surrounding the candidate seed point.

When the local intensity of a candidate seed point is measured as in claim 7, the intensity homogeneity is also evaluated as a direct result.

8. Regarding claim 9, Aylward reveals the following:

The method of claim 1 further comprising refining the seed point position by extrapolating toward the centerline from a plurality of boundary points (fig. 5), the boundary points representing positions on a surface of a generalized cylinder, and the seed point representing a position on a center axis of the generalized cylinder (refer to col. 4, lines 27-34, for a description of the properties of tubular objects, which correspond with the model of a generalized cylinder).

9. Regarding claim 10, Aylward reveals the following:

The method of claim 1 wherein the step of tracing the centerline of the line structure comprises translating from the seed point to a trace point (i.e. The gradient of the image at the seed point is then computed to provide the direction of maximum intensity assent, and a step is taken in this direction to a point at position x_i, col. 11, lines 33-36).

Aylward states that the point x_i will may lie on the centerline, but it might be an intermediate point of local maximum intensity (see col. 11, lines 2-5; fig. 5).

10. Regarding claim 12, Aylward reveals the following:

The method of claim 10 wherein the step of tracing the centerline comprises refining a position of the trace point.

See fig. 7 and col. 12, lines 22-31, where Aylward describes a "shift-maximize" process in which a calculated trace point location derived from a tangent vector is adjusted if it does not lie at a cross-sectional intensity maximum.

11. Regarding claim 16, Aylward discloses the following:

The method of claim 1 further comprising creating an image analysis output, the image analysis output selected from one of a graph-theoretic or a tabular representation.

Refer to fig. 17, which shows images of a vascular network obtained by vessel tracking. Aylward states that vessel connection information can be shown (col. 22, lines 42-49). This is a type of graph-theoretic visualization, which is one of the two alternative display methods specified in the claim.

12. Claim 23 is the same as claim 1, except that it refers to a system and means instead of a method. Aylward discloses a system for processing tubular objects. This system includes a computer processor and memory with stored instructions (col. 2, lines 42-54; col. 17, lines 45-59; fig. 15, items 1510, 1550). This constitutes an image analyzing system with means as described in claim 23. The computer is reconfigured by the instructions to become the claimed means when performing the method steps. Thus, claim 23 is rejected on the same basis as claim 1.

13. Claim 24 is identical to claim 1, except that it specifies a machine-readable storage device containing a program. Aylward also discloses the same type of device, as noted in the discussion of claim 23 (see fig. 15). Therefore, claim 24 is rejected on the same basis as claim 1.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aylward as applied to claims 1-4 above, and further in view of the article "Rapid Automated Tracing and Feature Extraction from Retinal Fundus Images Using Direct Exploratory Algorithms" by Can et al. (hereinafter called Can).

16. Regarding claim 5, Aylward reveals the method of claim 4, on which claim 5 depends. However, Aylward does not reveal the following:

> The method of claim 4, wherein the step of selecting the seed point comprises evaluating the boundary directions at the plurality of boundary points.

Can discloses a set of validation rules for seed point selection, and these rules require the evaluation of boundary directions (see p. 131, col. 2, lines 24-43). Aylward and Can

describe analogous art involving automated tracking of blood vessels. Therefore it would have been obvious to one skilled in the art at the time of the invention to modify the method of Aylward by including the filtering method of Can because this eliminates invalid seed points.

17. Regarding claim 6, Aylward reveals the method of claim 4, on which claim 6 depends, but he does not reveal the following:

The method of claim 4 wherein the step of selecting the seed point comprises evaluating a boundary edge at the plurality of boundary points.

This method is revealed by Can, who states, "...the tracing algorithm...is designed...to follow the strongest edge whenever a branch point is encountered...the tracing algorithm is initiated at several points, and the traces are combined." See p. 131, col. 1, lines 49-55. See also fig. 3 on p. 129.

Allowable Subject Matter

18. Claims 11 and 13-15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

19. Claims 17-22 and 25 are allowable because sections c, d, and e of independent claims 17 and 25 were not found in the prior art.

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael W. Bowen whose telephone number is (571)272-5969. The examiner can normally be reached on M-F 8AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (571)272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MWB

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